DOCUMENT RESUME

ED 381 585 TM 023 059

AUTHOR Bentley, Carol L.
TITLE Are Preservice Teachers Acquiring Skills in Educational Technology, How and Where? Results of a National Survey.
PUB DATE Oct 94
NOTE 25p.; Paper presented at the Annual Meeting of the Mid-Western Educational Research Association (Chicago, IL, October 13-15, 1994).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Computer Literacy; Computer Science Education; Computer Software; Curriculum; *Educational Technology; Education Majors; Elementary Secondary Education; Higher Education; Information Dissemination; *Skill Development; Student Characteristics; Surveys; Teacher Education; *Teacher Educators; *Telecommunications
IDENTIFIERS *Preservice Teachers

ABSTRACT

A survey was undertaken to acquire information about the preservice training of teachers in technology. The survey considered general information and student characteristics, learning about hardware and software, the dissemination of educational technology, and information about telecommunications technology. Thirty-two surveys were completed by directors of curriculum materials centers in schools of education, a response rate of 64%. While some type of preservice training in the use of educational software was provided at 27 schools, only 16 schools indicated that this training was provided in a required course. The largest collections of software for the use of preservice teachers concentrate on drill and practice programs, followed by problem solving, programming, word processing, staff development, and simulations and game programs. Survey findings suggest that the technological training received by preservice teachers is inconsistent and not focused, and that training in telecommunications is at minimum levels in many institutions. Four tables summarize findings. (Contains 22 references.) (SLD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 381 585

ARE PRESERVICE TEACHERS ACQUIRING SKILLS IN EDUCATIONAL TECHNOLOGY, HOW AND WHERE? RESULTS OF A NATIONAL SURVEY

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

CAROL L. BENTLEY

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

Presented by
Carol L. Bentley

Mid-Western Educational Research Association Annual Conference
October 13-15, 1994
Chicago, Illinois

BEST COPY AVAILABLE

INTRODUCTION

The Office of Technology Assessment of the Congress of the United States, did a study to better understand new technologies for improving learning (1989). Their report examined developments in the use of computer-based technologies .This report and others show that computers in public schools increased tremendously during the nineteen eighties. Diem (1982) noted that the availability and usefulness of computers in the classroom made computer literacy a necessity for most schools.

Quality Education Data, Inc. reported in 1985-86 that there were 800,000 computers in public schools and an average density of 50 students per microcomputer. (1986). In 1994 QED reports that there is an average density of fourteen students per microcomputer. This is a growth rate of more than 300%.

Recent literature and state reports as well as Goals 2000, all confirm that newer and more advanced uses of technology in the classroom will be the wave of the future. A vast majority of K-12 classrooms now have at least basic computer technology integrated into the curriculum. Many have gone far beyond and have access to telecommuniciations such as distance learning capabilities. Recently some elementary and secondary schools have been connected to Internet. All of this would most certainly suggest that new teachers entering the field should have basic knowledge and some experience in using educational technology in the classroom. In order for this to occur, preservice teachers need training and exposure to these

technologies doing their professional training. How and where are they receiving this training?

Several studies indicate that the experimental stage is still the norm for preservice teacher training at a majority of institutions. Handler (1992) found little evidence that typical preservice education programs provide many opportunities to work with technology. Beyond the basic introductory course to computers , the training has taken off in many directions. Some institutions offer elective courses for students who wish to take them; others provide opportunities in classes designed for a specific setting or audience; and still others work with computer education departments to plan training activities for preservice teachers.

Beaver (1992) describes a program at SUNY at Buffalo, N.Y. where students get computer exposure in an elective instructional technology course offered in a computer laboratory. He did a study that was prompted by a local superintendent of schools statement He stated that his district's plans were to employ teachers and administrators only if they demonstrated computer literacy.He found from this study that over fifty percent of elementary education majors had never used a microcomputer in any college course. More encouraging was the finding that the students recognized a need to develop greater computer competency. The program at SUNY was implemented in a systematic way to provide the following: (1) instructional computing exposure; (2) teach education majors database management, spreadsheet, manipulation, chart development, communications, and methods for integrating these skills into classroom instruction; and (3) training faculty members in education departments who lack expertise in the instructional use of technology. Northeastern

Illinois University of Chicago has developed a program involving the use of telecommunications in the curriculum. Participants in the program include college students, administrators and teachers and students of the participating schools. The components of this program are: (1) basic telecommunications training to send and receive messages; (2) use of telecommunications to receive and complete assignments; (3) development and design of electronic mail; (4) instructional use of telecommunications in grades K-12; and (5) and training in data retrieval. This program is designed to develop an understanding of the effectiveness of telecommuniciations as a curriculum tool. Some other examples of information received from this program include database activities, establishment of a sub-network for specific educational purposes, and use of tutorial. This program enables university students to model processes which could be shared with their K-12 students. This program also sensitizes them to opportunities for implementing telecommuniciations in their own curricula. (Aronin, 1992.)

An unusual approach has emerged from a band of collaborators in Texas. They devised a method of preparing future teachers in a real school environment. Through the active use of technology and teacher staff development, preservice teachers can practice, reflect, and learn in realistic classroom models. Each semester prospective teachers train in two elementary schools to develop their educational technology skills. The collaborators in this project were the San Marcos Consolidated Independent School District, Austin I.S.D., Southwest Texas State University Region XIII Education Service Center, and Century Telephone Company.Together they formed the Center

for Professional Development and Technology. (Curtin,et al, 1994).

Walter(1992) noted that training of teachers in computer literacy and usage has not kept pace with the increasing use of computer technology for instructional purposes. Preservice curricula should provide systematic exposure to technological enhancements at all levels. At the College of St. Elizabeth (New Jersey), the education faculty developed a project to establish a teacher education curriculum in which computers would be systematically integrated throughout course content and field experiences. Students acquire computer skills through a development process spanning four stages. The stages are awareness, adaptation, analysis, and application. These stages correspond to the four year comprehensive teacher education curriculum. The integration of computer competency within the curriculum focused on three major areas: curriculum and evaluation, student learning and development, and classroom and school.The Department of Education also established a Teacher Education Computer Laboratory containing computers, a cataloged software collection, professional journals, and audiovisual equipment. Every course in the education curriculum integrates into the course content hands-on assignments and projects that require computer utilization.

All of the above are prime examples of how diversified programs and activities are for training future teachers has become. Traditionally the Curriculum Materials Centers function was to support accredited professional programs in teacher education colleges and universities. This specialized collection of materials consist of both print and non-print materials. As we have moved into the computer age and

and more recently telecommunications and other higher technology capabilities for education, the Curriculum Materials Center may no longer be the focal point for these technologies that have become a vital part of teaching and learning.

To further illustrate the impact of technology in classrooms of the future we reviewed the reports of several State Board's of Education. These documents are informative on the status of technological advances in K-12 schools in these states. It also helps us to visualize what the picture will look like when our prospective teachers enter the classrooms of the future. What follows is a brief summary from these reports.

ILLINOIS - A policy study done by a staff study team reports on technology in Illinois schools and recommendations made to the State Board. (The 21st Century Challenge: Transforming Education Through Technology. 1993.) Even though fewer then ten percent of Illinois school districts are making use of multiple technologies, there is support for technology use. Illinois has placed satellite receivers in sixty local school districts. There are several distance learning networks in Illinois. There are a number of other technological advances in the school districts of Illinois, Tech Prep is a statewide initiative to improve the mathematics, science, communications and technical skills of high school age students. Eighteen Education Service Centers are responsible for the application and evaluation of educational software, technical assistance, and curriculum development. The State Board participates in several electronic communication networks. This report recommends that the State Board convene a coalition of representatives of various groups to develop a state level strategic plan for the comprehensive integration of technology in Illinois schools.

IOWA - The report of the Technology Commission of the State of Iowa has

made

specific action recommendations for the State Department of Education (Technology for Education in Iowa. April, 1994). This commission was appointed in 1992 to be a forum for the creative uses of technology in Iowa's schools. The IDEA (Iowa Distance Education Alliance functions to: 1) utilize the educational component of the Iowa Communications Network to provide educational opportunities for Iowa's K-12 students; 2) establishes a telecommunications partnership between teachers and administrators from local school districts , the Iowa Department of Education and other agencies. This alliance also has a preservice teacher component. The purpose of this component is to provide Iowa preservice teachers with activities, information, and experiences that will enable them to teach at a distance. ICN (Iowa Communications Network) was scheduled to be in operation by the fall of 1993. This information highway links Iowa's K-12 schools, area education agencies, community colleges, public and independent colleges and universities; connects telecommuniciations classrooms in each of Iowa's 99 counties; and provides a statewide two-way full-motion interactive telecommuniciations network utilizing fiber optic technology.

MICHIGAN - I n 1990 the State Board of Education adopted fourteen goals in a document entitled "Education: Where the New Century Begins" (Michigan's State Technology Plan, 1992-97). The plan calls for the development of a five-year state technology plan. This plan provides recommendations to maximize the impact of technology on the restructuring of schools. The twenty-two recommendations they make are categorized into five major themes. Two of the five themes are relevant

to this summary: restructuring schools using technology, and statewide systems for teaching, learning, and communication.Under restructuring schools two of the recommendations are : each education institution must recognize the new technological skills needed by current and future workers, and schools must integrate technology throughout the curriculum and should develop a technology education curriculum. Statewide systems for teaching, learning, and communications recommends that a computer network should be established that is accessible by all educational institutions, including K-12 classroom teachers.

OHIO - The State Plan for Technology prepared for the State Board of Education of Ohio has established goals to be achieved within specific time lines. (State Plan for Technology for the State Board of Education of Ohio. 1992) A number of agencies in the state of Ohio have been charged with providing technology materials and support services to Ohio schools. The strategic plan of the State Board of Education articulates the effective use of technology as being vital to accomplishing it's mission. SchoolNET a project initiated by the governor has three components, one of which is to wire each public school classroom in Ohio, The strategic plan consists of five instructional goals. From these goals, specific measurable objectives have been identified as some indication of achievement. Goal three for example, is to integrate technology throughout the curriculum to: personalize learning; address cognitive, affective, and psychomotor learning; enhance the creative, problem solving, and critical thinking dimensions of learning. To achieve goal three there are two objectives as follows: By 1994, teachers and students will be able to use technology to address the fact that human beings possess multiple intelligences, learn differently,

at different rates, and in different ways. By 1994, teachers and students will be able to use technology to facilitate multidimensional learning. Other goals and objectives include using technology to change learning designs, to facilitate instructional programs that are interdisciplinary in nature, and to extend the boundaries of the l earning environment.

WISCONSIN - The state of Wisconsin has twenty standards which are required of districts. Standard k requires that computer literacy be integrated into all other academic disciplines. The Wisconsin Department of Public Instruction published a guide to curriculum planning in computer education (State of Wisconsin Department of Public Instruction). This guide under Standard k includes specific requirements that the school district curriculum plan shall provide that computer literacy objectives and activities shall be integrated into the K-12 curriculum plans.This department created a consultant position for Microcomputer Technology to assist schools using microcomputers. This consultant also has the responsibility of planning activities for staff development One example of this is the development of a team Technology Awareness course in collaboration with some of the state universities. This course will provide information on planning for technology and assist educators in methods of generating an awareness in their schools.

Each of these state reports reinforce what we already know, that changes are taking place in teaching and learning resulting from the technological advances of today. Each state has already implemented the basics toward fully employing these technologies into restructuring schools and integrating them into the academic

disciplines. Collaboration between public schools and universities who train teachers is the next logical step toward empowering those who will be responsible for classroom applications of educational technology

PURPOSE

This survey was taken for the purpose of acquiring information to help teacher educators and resource professionals make some assumptions based on facts about the preservice training of teachers in technology. The survey was done under the following five sub-headings: (1) General information (student enrollment, teacher training programs, etc.); (2) Hardware technology; (3) educational software; (4) Dissemination of educational technology; and (5) Telecommunications technology. The findings in each category as a whole will determine the availability and training for preservice teachers in educational technology on those campuses selected for this survey. The institutions selected represent a good cross section of all institutions of higher education.

METHODOLOGY

The survey was sent to fifty director's of Curriculum Materials Centers as defined by the Directory of Curriculum Materials Centers published by the Education and Behavioral Sciences section of the Association of College and Research Libraries.The Curriculum Materials Centers were selected by an analysis of their statement of purpose such as "The Center supports the teacher education program by acquiring, organizing and providing a collection of preschool through high school curriculum materials for use by students and faculty," or "A non-print collection of curriculum materials for grades K-12 to support the School of Education". The other

criteria for selection was the organizational structure of the institution that placed the Curriculum Materials Center under the administration of the academic library or under the College of Education . Thirty-two surveys were returned resulting in an above average response rate of 64%. Seventeen Center's were administered by the academic library, twelve by the College of Education, and three by other related departments.

The population for this study was the preservice teacher student body of fifty institutions of higher education nationwide.

FINDINGS

The student enrollment in the College's of Education in the survey ranged from 227 to 1,000 at the graduate level. The undergraduate enrollment ranged from 300 to 3,000 students.

Some type of training of preservice teachers in the usage of educational software was provided at twenty-seven schools. Five reported no programs were offered. The kind of training being done varies and sometimes overlaps in how and where it takes place. In Table I we see that half of the responses (16) indicated that training was done as a required course. A somewhat greater number (20) receive less formal training in a computer laboratory/hands-on experience setting. We also see that at nine institutions the students receive instruction and hands-on experience in the Curriculum Materials Center. Some other responses were a requirement by the College of Education that students evaluate K-12 software and in another instance the offering of an optional elective course in computer software was open to students.

Table IV shows the location of where computer laboratories are accessible to the students. This survey would indicate that there are computer labs in a number of places on campus. They are in the CMC; College of Education; Academic Library;and elsewhere on campus. Accessibility of computers on campus does not seem to be a problem for preservice teachers. This does not however translate into having the appropriate software and supervision for integrating it into strategies for classroom teaching The assumption is that in the sixteen required courses, students are actively involved in this process. However, methods for totally integrating technological resources into the curriculum requires a multimedia approach. If the equipment and Facilities are not available this cannot take place.

Educational software collections are also dispersed in different locations on campus. The Curriculum Materials Center was listed as the location of educational software collections at twenty-four institutions. Other locations where software could be found were: the academic library, computer laboratories, and the College of Education. A very important factor in having software available to preservice teachers is the quality of the programs for training.

. In response to the survey question on content of software programs, Table II shows that an average of 25% of the programs are drill and practice, 19% are problem solving, 7% programming, 18 % word processing, 15% staff development, and 28% simulations and games. The largest collections are drill and practice and simulations and games. This places a certain amount of limitation on creativity in utilizing these programs in the classroom. Table II also shows a larger percentage of computer

software in these collections are for the elementary school. By and large these are commercially done software programs. This may indicate that there are less secondary level programs being produced.

The depth of training being received by preservice teachers is questionable from what the survey reveals. Utilization of educational software falls into three categories for the most part.To familiarize themselves with a wide variety of programs was the most frequent response. To evaluate the content of instructional programs was second and the use of word processing third. Using computer courseware effectively for integrating it into the curriculum entails a more complex usage than those stated above. It seems obvious from these responses that the use of computer technology by preservice teachers is for the most part superficial with a low level of integration into the curriculum. Virtually no utilization by preservice teachers for writing computer programs exist While this is not unusual the possibility that they may be learning to adapt existing programs to meet instructional objectives would be a desirable goal.There is also a limited usage of word processing and searching professional journals Knowledge of using computers in the search for information mode may be accomplished in other college courses, but there should be opportunities provided for relating this information to classroom practice techniques for future teachers. Equipped with the knowledge and computer related tools (word processing, graphics programs, databases,spreadsheets, etc.) one can create their own software programs adapted to specific instructional purposes. Handler (1992) noted that few preservice teachers had practiced using the computer to teach a lesson during their field experiences. Furthermore, few preservice education programs provide opportunities to work with

technology.

Telecommunications technology equipment for training teachers is in existence at approximately half of the institutions. From the current literature on this topic we may make a reasonable assumption that this media is rapidly becoming a powerful tool in education and school reform and restructuring. Table IV shows that only nine schools had programs for preservice teachers in distance learning technologies. Of these programs Curriculum Materials Centers were involved in the training in only one. Electronic media requires the services of many highly trained personnel and specialist in the field. The equipment and facilities to operate are expensive. These variables alone can account for the slow emergence of these technologies in teacher training programs. With the Internet being funded for many elementary and secondary schools, there is a real need to began to develop programs for the undergraduate education students. In institutions of higher education, distance learning technology will probably be consolidated in some designated facility on campus for the entire campus usage. Preservice teachers will also probably be trained at this facility wherever it is located. These technological capabilities already exist at many of the schools. Table IV shows that thirteen schools have fiber optic technology, eighteen have telecommuniciations, and fourteen have networking tools.

CONCLUSIONS

Two very important issues are explicit in the responses received from this survey. The are: (1) there is no consistent and focused program for all preservice teachers to provide them the training needed to utilize educational technology to

revitalize classroom teaching; (2) Training in the use of telecommuniciations technology is at a minimum level in some institutions and no programs exist in many i institutions. These findings confirm those of Handler (1992) who found that required courses in technology education has not been a priority in teacher education programs. This and other studies as well as the State Departments of Education reports shows evidence of the need for providing more and better instruction for preservice teachers in using technology for an integrated approach in teaching. Handler suggests that certain programs and the facilities are in place at some institutions for a beginning. Such programs as Writing Centers, Writing Across the Curriculum and Centers for Academic Development could offer workshops in word processing for students. She also describes some cooperative efforts between teaching faculty and the Computer Education Department at her institution. These activities allowed faculty an opportunity to co-teach and plan lessons using the computer with colleagues who are less comfortable with using the computer in their instruction. As a result a number of activities have been developed with these colleagues to support methods courses in different subject areas. Other opportunities avail that introduce faculty and students to software programs useful for elementary, middle, and junior high in language arts. Joint planning with methods teachers and computer education faculty has resulted in sessions in the computer laboratory with these teachers and their students. These sessions range from demonstrations of software to students selecting software and determining a way it may be integrated into a lesson plan. Three components are necessary in the preparation of preservice

teachers are revealed in Handler's study. These components are: facilities for using technology (computer labs, computer education departments, etd.), assisting methods teachers to use technology in their classes, and teaching students to integrate technology into instructional planning.

To reiterate the issues that were the major concern of this study, are future teachers acquiring skills in the use of educational technology, if so how and where? What we found in essence is that the planning stages are definitely being developed and the implementation of of these plans is already taking place in many institutions. Basic training in computer technology is occurring in some format. More advanced uses of telecommunications technology is still quite limited. To reach the desired goals for programs to adequately prepare these students for using technologies at least two factors are necessary. There must be available funding for the appropriate equipment and facilities. Cooperation and collaboration between faculty in the college of education, computer education faculty, technology specialist and, resource professionals is very essential. The resource professionals including curriculum materials librarians are prepared to assist in their role as information specialist. Other than the computer laboratories the academic library is the major source of educational technology on most campuses. The technology is there for exploration of what is available and how to access it. To successfully merge the print media and electronic media into instructional goals and objectives for classroom teaching all of the above mentioned must apply. The Curriculum Materials Center has a role in the coexistence of the two media formats. Working as a team these resource information specialist, technology specialist, and subject methodology

specialist can execute a plan to train preservice teachers to use educational technology in their unit and lesson plans as a prelude to fully integrating it into the curriculum. This formula may consist of selection of materials (curriculum librarians), experimentation (computer laboratory personnel), utilization and integration , (methods instructors).

Even this formula may be obsolete before it is fully operational. Already there is a product being developed at the Center for Excellence in Education at Indiana University called the Virtual Textbook. This software promises to replace the textbook. It's goal is to move students beyond simply mastery of content to becoming information seekers and to acquire the ability to find solutions to problems themselves. Siegel, Sousa (1994). With the advancements in PC technology capabilities surfacing faster than society at large can absorb them, teachers and students are likely to acquire skills simultaneously in the classrooms of the future.

TABLE I

EDUCATIONAL SOFTWARE TRAINING

Preservice teacher training programs in using educational software

N	Programs	No Programs
32	27	5

Methods of training

Required Course	Computer Laboratory/ Hands on Exp.	Instruction given in CMC	Other
16	20	9	2

TABLE II

ACCESSIBLY AND UTILIZATION OF EDUCATIONAL SOFTWARE

Software collections not in the Curriculum Materials Centers

N	Location
4	Academic Library
5	College of Education
9	Computer Laboratory
1	Learning Resource Center

How software is utilized by preservice teachers

To familiarize with programs	To evaluate programs	To use word processing	To write programs
25	22	18	0

TABLE III

SCHOOL LEVELS AND FORMAT OF SOFTWARE PROGRAMS

Average Percentage of software at each school level

Elementary school	58.7%	Secondary school	35.5%
College level	17.6%	Professional level	9.3%

Average Percentage of Format of software programs

Drill and practice	25.1%	Problem solving	19.1%
Simulations and games	27.7%	Staff development	15.3%
Word processing	17.7%	Programming	6.9%

TABLE IV

COMPUTER LABORATORIES AND TELECOMMUNICATIONS TECHNOLOGY

Locations of computer labs accessible to preservice teachers

N: 32

Curriculum Materials Centers	21
Colleges of Education	21
Academic Library	16
Elsewhere on campus	15

Telecommunications equipment located in the CMC

YES	NO
9	23

College of Education programs for training preservice teachers in distance learning technologies

YES	NO
9	19

Technologies in existence for training teachers at these institutions

N: 32

Fiber optics technology	13
Telecommunications technology	18
Technology that can connect one system to another	14

LIST OF SURVEY QUESTIONS

1. What is the student enrollment in the College of Education ?
   Graduate_____

   Undergraduate_____

2. The Curriculum Materials Center is under the administration of what governing body?

3. Does the College of Education have a preservice teacher training program in using educational software?

4. If so, how is the training done?

5. Where on campus is a computer laboratory accessible to education students?

6. Where on campus is educational software collected other than the CMC?

7. Do preservice teachers receive computer literacy instruction in the Curriculum Materials Center?

8. Basically how does preservice teachers utilize educational software programs?

9. Does the Curriculum Materials Center have a collection of educational software?

10. Approximately what percentage of your software programs are?

11. Approximately what percentage of your software is for?

12. Are there distance learning networks that connect classrooms, businesses and communities for instructional purposes?

13. Does the College of Education have programs for training preservice teachers in distance learning technologies?

14. If so, is the Materials Center involved with the training?

15. What other electronic media technologies are in existence at your institution?

REFERENCES

Aronin, Gene. (1992). *Preparing Teachers for a Shrinking World.* (ERIC Document Reproduction Service No. ED351 319).

Beardslee, Edward C., Davis, Geoffrey. (1989). *Interactive Videodisc and the Teaching-Learning Process.* Fastback. Phi Delta Kappa Educational Foundation.

Beaver, John F. (1990) *A Profile of Undergraduate Educational Technology (IN) Competence: Are we Preparing Today's Education Graduate for Teaching in the 1990's.* (ERIC Document Reproduction Service No ED 332 985.

Bitter, Gary G., Yohe, Roger L. (1989, March). *Preparing Teachers for the Information Age.* Educational Technology, 29 (3), pp 22-25.

Curtin, Pat, Cochrane, Lucy, Avila, Linda, et al. (1994) A Quiet Revolution in Teacher Training. Educational Leadership. 51, (7) pp 77-80.

Diem, Richard A. (1982) *The Role of Technology in Teacher Education: Preparation for the Twenty-first Century Classroom.* (ERIC Document Reproduction Service No. 212 596)

Green, James E., and Weaver, Roy A. (1990) *Tech Prep: A Strategy for School Reform.* Fastback. Phi Delta Kappa Foundation.

A Guide to Curriculum Planning in Computer Education. (1990) State of Wisconsin. Department of Public Instruction.

Handler, Marianne G. (1993) *Preparing New Teachers to use Computer*

Technology: Perceptions and Suggestions for Teacher Educators. Computer Education. 20 (2), pp 147-156.

Hayes, Jeanne, ed. *Microcomputer and VCR Usage in Schools, 1985-86. (1986).* Quality Education Data. Denver, Colorado.

Lee, In-Sook, and Reigeluth. (1994). *Empowering Teachers for New Roles in a New Educational System.* Educational Technology. pp 61-71.

Loper, Ann Booker, et al. (1985) Use of a Microcomputer-Based Simulation to Enrich Teacher Training Education. Educational Technology 25 (12), pp 36-37.

Michigan State Technology Plan ,1992-97. (1992). Executive Summary. Michigan State Board of Education. Lansing, Michigan.

Office of Technology Assessment. (1989) Congress of the United States. *Power On! New Tools for Teaching and Learning.* Superintendent of Documents. U.S.Government Printing Office. Washington, D.C.

Osier, Donald V., et al. , comp. (1990) *Directory of Curriculum Materials Centers.* Association of College and Research Libraries. A Division of American Library Association. Chicago, IL.

Quality Education Data, Inc. (1994). *Technology in Public Schools, 1993-94.* Denver, Colorado.

Siegel, Martin A. and Sousa, Gerald A. (1994) *Inventing the Virtual Textbook: Changing the Nature of Schooling.* Educational Technology. 9 , pp 49-54.

State Plan for Technology for the State Board of Education of Ohio (1992). State Board of Education of Ohio. Columbus, Ohio.

Technology for Education in Iowa. (1994) The Report of the Technology Commission. State of Iowa Department of Education. Des Moines, Iowa.

The 21st Century Challenge: Transforming Education Through Technology. (1993). Policy Study for the Illinois State Board of Education Springfield.

Walters, Joan T. (1992) Technology in the Curriculum: The Inclusion Solution. (ERIC Document Reproduction Service No. ED350 281).